ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)		DATE February 2000
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602712A Countermine Applied Research	

COST (In Thousands)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	10265	14380	12386	12639	12905	13340	13875	Continuing	Continuing
AH24 Countermine Technology	7976	12286	9976	10174	10385	10664	11076	Continuing	Continuing
AH35 Camouflage Technology	1956	2094	2410	2465	2520	2676	2799	Continuing	Continuing
AC61 AC61	333	0	0	0	0	0	0	0	1992

A. Mission Description and Budget Item Justification: The objective of this program element (PE) is to research advanced technologies to improve countermine, signature management, and deception capabilities. Countermine research areas include close-in detection of individual mines using manportable technologies; detection and neutralization from moving vehicles; and remote detection of minefields; while reducing false alarms and increasing operational tempo. In addition, this PE is investigating advanced robotics technologies to minimize threats to weapons systems and to personnel and detection/ neutralization techniques for both conventional and electronically activated mines. A Center of Excellence (COE) for land mine detection will coordinate and standardize the development of mine signature simulations; provide a catalogue of mine signatures; and support evaluation of mine detection algorithms. This PE also researches deception and advanced signature management techniques that will ultimately provide combat units (e.g. Digital Tactical Operations Center, Small Unit Operations, Special Forces, Theater Missile Defense) with an integrated system of devices that deliberately alter the adversary's perception of friendly force capabilities and intentions. The Army has focused its resources and is expediting these programs in coordination with the US Marine Corps. The work in this program element is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and adheres to Tri-Service Reliance Agreements on conventional air/surface weapons and ground vehicles. Work in this program element is related to and fully coordinated with PE0602709A (Night Vision and Electro-Optics Technology), PE 0603606A (Countermine and Barrier Development), and PE0603710A (Night Vision Advanced Technology).   This program is managed by the Communications-Electronics Research, Development and Engineering Center (CERDEC), Night Vision Electronic Sensors Directorate (NVESD), Fort Belvoir, VA.

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B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000/2001 PB)	10547	10321	10453
Appropriated Value	10715	14521	
Adjustments to Appropriated Value			
a. Congressional General Reductions	-168		
b. SBIR / STTR	-178		
c. Omnibus or Other Above Threshold Reductions	-2	-50	
d. Below Threshold Reprogramming	-60		
e. Rescissions	-42	-91	
Adjustments to Budget Years Since (FY 2000/2001 PB)			-67
New Army Transformation Adjustment		TBD	+2000
Current Budget Submit (FY 2001 PB)	10265	14380	12386

Change Summary Explanations: Funding – FY 2001: Project AH24 adjusted to reflect the new Army Vision/Transformation.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 2000

BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602712A Countermine Applied Research	PROJECT AH24

COST (In Thousands)	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH24 Countermine Technology	7976	12286	9976	10174	10385	10664	11076	Continuing	Continuing

A. Mission Description and Justification: Countermine research focuses on the remote detection of minefields, and the detection and neutralization of individual mines from vehicular and manportable platforms. Neutralization techniques will be investigated for both conventional and electronically activated mines that can be detected and neutralized at a standoff distance. Data collection platforms will be utilized for sensor and algorithm assessments and testing of advanced mine detection technologies. Mine detection and neutralization technologies and techniques will provide enhancements addressing improved probability of detection, reduced false alarms and improved operational tempo. The COE for land mine detection coordinates and standardizes the development of mine signature simulations, provides a catalogue of mine signatures, and supports evaluation of mine detection algorithms.

FY 1999 Accomplishments:

- 1465 – Completed performance trade-off analysis and evaluation of alternative multispectral imaging sensor technologies for a lightweight airborne minefield detection capability.
  – Collected mine signature data to support finalization of phenomenology studies and mine detection algorithm development.
  – Tested critical component modules for the lightweight airborne mine detection sensor.
- 4573 – Evaluated revolutionary new acoustic/laser approaches from the University of Mississippi for advanced mine detection. Evaluated the following advanced mine detection sensor technologies: 3D Synthetic Aperture Radar (SAR)/ Ground Penetrating Radar (GPR), Nuclear Quadrupole Resonance (NQR), and novel metal detector technologies.
  – Completed test and evaluation of alternative neutralization technologies and down selected the most effective approach of precision explosive emplacement.
  – Evaluated preliminary development of advanced sensor fusion/aided target recognition (ATR) processing and integrated with vehicle mounted mine detector sensors.
  – Evaluated the fundamental phenomenology for forward-looking mine detection technologies.
- 1465 – Completed preliminary research on eddy current decay analysis techniques to reduce false alarms and provided detection and classification capabilities for surface and buried metallic mines.
  – Assessed high dynamic range radar, giant magneto-resistive arrays, and acoustic mine detection techniques/capabilities to improve detection performance of hand-held and vehicular mounted mine detectors.
- 473 – Enhanced mine signature simulations, cataloguing of mine signatures, and assessments of mine detection algorithms in support of land mine detection COE.

Total   7976

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FY 2000 Planned Program:

- 1500 – Design laser illumination source with charge coupled device (CCD) camera for mine phenomenology data collections to support definition of surface mine detection approaches for an airborne platform.
  – Evaluate laser/CCD camera testbed and collect data and supporting ground truth with the goal of defining conditions and observable phenomena to optimize the multi-sensor approach.

- 3011 – Evaluate and assess the advanced mine detection sensors and down select to the most promising technologies and techniques. Collect and analyze data to evaluate improvements in probability of detection and reduction of false alarm rates.
  – Complete design and trade off analyses of a acoustic laser Doppler vibrometer breadboard prototype to determine system parameters for detecting mines at greater standoff distances with possible application into the forward looking or confirmation technology areas.
  – Evaluate industry/academia concepts and technologies with potential to increase probability of detection, reduce false alarms or increase standoff distances as means to enhance force mobility and survivability.
  – Setup standards and techniques for evaluation of these confirmation technologies at various test sites.
  – Design and develop processing capabilities for acoustic/laser, 3D SAR/GPR, NQR and novel metal detector technologies for the advanced mine detection sensors program to reduce false alarms and increase operational tempo.

- 500 – Enhance mine signature simulations, update database of mine signatures, and established methodology for evaluation of detection algorithms in support of land mine detection JUXOCO.

- 2800 – Evaluate forward looking detection sensor designs (GPR and infrared (IR)) through testing in temperate environments of surface and buried anti-tank (AT) mines with the goal of demonstrating improved probability of detection and reduced false alarm rates for on route mission scenarios.
  – Evaluate forward looking detection sensor technologies with the goal of improved probability of detection and reduced false alarm rates while increasing operational speed.
  – Transition technologies into data collection devices for continual evaluation and assessment of sensors and algorithms.

- 1800 - Evaluate and assess acoustic laser doppler vibrometer (LDV) against AT and anti-personnel (AP) mines on varied environmental backgrounds. Design, build and assess new laser source technologies for LDV to increase area coverage and reduce scanning time. Reduce and isolate acoustic noise at LDV receiver for increased detection of mines.

- 1400 - Evaluate standoff GPR / IR technology testbed in temperate environment against AT mines at standoff distances of 10-30 meters. Buried and surface AT mines will be the threat space for phenomenology evaluations for standoff mine detection

- 1000 - Investigate non-linear acoustic technology for AT mine detection. Testbed will be evaluated against surface and buried AT mines in realistic environments along with modeling of acoustic phenomena.

- 275 - Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992.

Total   12286

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602712A Countermine Applied Research	PROJECT AH24

FY 2001 Planned Program:

- 3776 – Complete explosive specific confirmatory sensor brassboard prototypes for field experiments and evaluation.
  – Complete field experiments using realistic explosive concentrations to establish the prototype's operational envelopes as a function of target type, environment, and operational speed.
  – Complete maturation of higher risk technologies from DARPA's chemical detection program and select the most promising approach that yields lower false alarm rates and faster operational speeds.
  – Demonstrate and test acoustic/laser, 3D SAR/GPR, and NQR for use as confirmation sensors.

- 500 – Enhance mine signature simulations, update database of mine signatures, and establish methodology for evaluation of detection algorithms in support of land mine detection JUXOCO.

- 3700 – Evaluate brassboard forward-looking detection systems for detection of surface and buried AT mines that will improve probability of detection and reduce false alarms.
  – Evaluate initial ATR and sensor fusion algorithms for forward looking detection sensors, which will improve the probability of detection and reduce false alarm rates, while increasing operational speeds.
  – Evaluate potential of acoustic, time domain electromagnetic induction sensors and advanced mine detection sensors for inclusion in on going downward and forward looking mine detection programs as primary detection sensor.

- 2000 - Funds will be used in support of the New Army Vision/Transformation.

Total 9976

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE **February 2000**

BUDGET ACTIVITY **2 - Applied Research**	PE NUMBER AND TITLE **0602712A Countermine Applied Research**	PROJECT **AH35**

COST *(In Thousands)*	FY1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
AH35 Camouflage Technology	1956	2094	2410	2465	2520	2676	2799	Continuing	Continuing

A. Mission Description and Justification: This project researches advanced signature management and deception technologies that alter the threat perception of friendly force capabilities and intentions and deny acquisition of friendly force assets from threat sensors. This research will support development of systems to provide Tactical Operations Centers, and other combat units, with the capability to camouflage friendly assets and project a deceptive image of friendly forces. This improves the survivability of combat units in global battlefield conditions. Specific research areas include, holographic techniques; advanced materials and processes for visual and infrared deception devices; radar and communications approaches for deception modules; advanced modeling and simulation for signature management and deception technologies; and advanced materials, coatings, patterns, and appliques for suppression of electro-optical signatures of combat units.

FY 1999 Accomplishments:
- 1956 – Investigated holographic techniques, materials, and processes to support development of visual and infrared deception system modules.
  – Completed feasibility studies including evaluation of communications, situation awareness sensors, and projection technologies required for an integrated modular electronic deception system (IMEDS).
  – Designed modeling and simulation efforts to support design and evaluation of concepts, systems, and operational effectiveness for signature management and deception systems.
  – Conducted assessment of signature management and deception technologies with application to combat units.

Total   1956

FY 2000 Planned Program:
- 2043 – Evaluate holographic techniques, materials, and processes for visual and infrared deception devices.
  – Develop modeling and simulation capabilities for design, development and evaluation of signature management and deception technologies
  – Develop and evaluate technologies to support the development of visual and electro-optic deception modules.
  – Demonstrate radar and communications capabilities for use in deception modules.
  – Investigate optical communication technologies to suppress combat unit RF signatures.
  – Develop and evaluate patterns, coatings, and appliques for suppression of visual and electro-optical signatures of combat units.
- 51 - Funds reprogrammed for SBIR/STTR programs in accordance with the Small Business Innovation Research Authorization Act of 1992.

Total   2094

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BUDGET ACTIVITY **2 - Applied Research**	PE NUMBER AND TITLE **0602712A Countermine Applied Research**	PROJECT **AH35**

FY 2001 Planned Program:

- 2410   – Demonstrate holographic techniques in the laboratory for improved deception capabilities for combat units.
  – Evaluate effectiveness of advanced signature management and deception technologies through modeling and simulation in laboratory demonstrations.
  – Demonstrate techniques that combine physical and electronic decoys with signature management technologies to improve survivability of combat and combat support units.

Total   2410

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